

WHAT IS CLAIMED IS:

1. A method for single molecule identification of a target DNA
5 molecule in a random coil state comprising the following steps:
 - a) attaching an optically distinguishable material to a DNA sequence recognition unit;
 - b) hybridizing said DNA sequence recognition unit to said target DNA molecule in a random coil state to form a hybridized DNA complex in a
10 random coil state;
 - c) stretching said hybridized DNA complex in a random coil state to form a hybridized DNA complex in a substantially linear configuration; and
 - d) detecting said optically distinguishable material in a sequential manner along said substantially linear hybridized DNA complex, thereby
15 identifying said target DNA molecule.
2. The method of claim 1 wherein said optically distinguishable material comprises colored microparticles.
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3. The method of claim 1 wherein said optically distinguishable material comprises microparticles having different shapes.
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4. The method of claim 2 wherein said colored microparticles comprise dyes, dye aggregates, pigments or nanocrystals.
5. The method of claim 1 wherein said DNA sequence recognition unit comprises DNA, DNA fragments, synthetic oligonucleotides or peptide nucleic acids.
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6. The method of claim 1 wherein said DNA sequence recognition units comprise any protein scaffold or synthetic molecular moiety capable of recognizing a specific DNA sequence.

7. The method of claim 1 wherein said stretching of said hybridized DNA complex in a random coil state to form a hybridized DNA complex in a substantially linear configuration is accomplished by using a
5 mechanical means.

8. A method for single molecule identification of a target DNA molecule in a random coil state comprising the following steps:

- a) stretching said target DNA molecule in a random coil state to
10 form a substantially linear configuration;
- b) attaching an optically distinguishable material to a DNA sequence recognition unit;
- c) hybridizing said DNA sequence recognition unit to said target DNA molecule in a substantially linear configuration to form a hybridized DNA
15 complex in a substantially linear configuration; and
- d) detecting said optically distinguishable material in a sequential manner along said substantially linear hybridized DNA complex, thereby identifying said target DNA molecule.

20 9. The method of claim 8 wherein said optically distinguishable material comprises colored microparticles.

10. The method of claim 8 wherein said optically distinguishable material comprises microparticles having different shapes.

25 11. The method of claim 9 wherein said colored microparticles comprise dyes, dye aggregates, pigments or nanocrystals.

30 12. The method of claim 8 wherein said DNA sequence recognition unit comprises DNA, DNA fragments, synthetic oligonucleotides or peptide nucleic acids.

13. The method of claim 8 wherein said DNA sequence
recognition units comprise any protein scaffold or synthetic molecular moiety
capable of recognizing a specific DNA sequence.

5 14. The method of claim 8 wherein stretching of said
hybridized DNA complex in a random coil state to form a hybridized DNA
complex in a substantially linear configuration is accomplished by using a
mechanical means.

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